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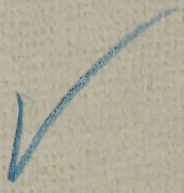
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# Sensory and Sensory-Motor Disturbances.

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## A STUDY OF THE SENSORY AND SENSORY-MOTOR DISTURBANCES ASSOCIATED WITH INSANITY, FROM A BIOLOGICAL AND PHYSIOLOGICAL STANDPOINT.<sup>1</sup>

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THIS is a second and more comprehensive attempt to apply the theory of evolution in the study of the various manifestations of insanity; studying the subject, as stated in the title, from the standpoint of development and function. In my experience with the insane, I have often felt that clinical observation and pathological anatomy did not furnish sufficient data for the thorough understanding and proper appreciation of diseased cerebral functioning, more especially when their application to the cure of insanity is considered.

From this want has sprung, I believe, the therapeutic scepticism and, in some cases, almost nihilism, which biases the minds of a great many asylum physicians. If, however, we apply the theory of evolution to the study of our cases, we are furnished with a working hypothesis which, to my mind, explains the facts as nothing else will. It seems to me, therefore, that there is room in the realm of scientific psychiatry for the builder of hypothesis, as well as for the pathological anatomist.

To the physician associated with the insane, as they are seen aggregated in asylums, insanity and the disorders associated with its various forms make a different picture than they do to the physician in general neurological practice. The asylum physician's continuous and intimate association with his patients, gives him opportunities for comparison and generalization which do not come to those outside, who see their patients at most

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<sup>1</sup> Read at the meeting of the American Neurological Association, New York, June 22, 23 and 24, 1892.

daily, and generally at much longer intervals; consequently the asylum physician sees more conspicuously marked, the individuality of the patient, and by comparison he is enabled to see more clearly the influence of environment and association, in the production of insanity, independently of morbid conditions.

The study of sensory and sensory-motor disturbances and their significance has been definitely developed by the neurologist, in connection with functional disturbance and gross lesion of the brain and general nervous system, and, as a rule, independently of any association with mental disturbance. This is natural; because, in the first place, patients manifesting both conditions are generally secluded in asylums, and on account of their mental disturbance do not make profitable material for objective study; but probably principally because the insane patient lives so long, and the sensory and motor disturbances vary so much, that the modern pathological neurologist, who lives but to verify his diagnoses post-mortem, has not the patience to continue the study. It has sometimes seemed to me also that the neurologist, while knowing the physical basis of insanity, does not fully appreciate that the manifestations of consciousness depend upon cerebral functioning, and that the mind, so called, is not an entity, therefore its disturbances are due to the same causes which produce disturbance in the general nervous system. Furthermore, the sensory and motor disturbances associated with insanity are seldom due to spinal or gross central lesion; and, consequently, are more truly indicative of abnormal and perverted cerebral functioning than are those dependent upon rapidly destructive nervous disease or gross brain lesion. The primary difference between sensory and motor disturbance occurring in insanity and general nervous disease, is the marked tendency to variation, and appearance and disappearance of the symptoms in the former, even where the sensory manifestations and disturbance of motility are as apparently persistent as in gross lesion of the brain and spinal cord. To study understandingly



the nature of sensory and motor disturbance in insanity, it becomes necessary to erect a pathological framework, into which the various manifestations can be fitted more or less accurately; and as the absence of definite lesions in most cases leaves us no tangible pathological entity upon which to base our deductions, it becomes necessary to formulâte an hypothesis, to explain the functional disturbance which originates and accompanies the perverted and excessive sensory and motor activity in these cases. There remains a certain percentage of asylum patients, who are suffering from actual gross lesion of the brain and spinal cord; but these cases in no wise differ from those due to general nervous disease independent of insanity, and, therefore, do not afford material for discussion here. The pathological history of insanity is known to be vague and indefinite, and from an anatomical standpoint furnishes very little information to the student in search of definite morbid changes which will explain the clinical manifestations of diseased cerebral functioning. This apparent absence of definite anatomical change I believe to be inherent in the conditions which give rise to insanity; and in the fact that the majority of cases of insanity, which furnish material for post-mortem study, have, though furnishing widely different clinical pictures during the earlier manifestations of disease, existed in terminal dementia for a sufficient length of time before death to obscure any definite pre-existing lesion in the general degenerative changes common to them all. Even in those cases where post-mortem definite lesions are found, the history of the progress of the case will show that the symptoms which the lesion apparently explains, have been engrafted upon pre-existing insanity, and have only an accidental relation to the primary condition. In the remaining increment of cases, where insanity has followed gross lesion of the brain, the perversions by which it manifests itself are in no wise different from those where no such lesion has been found to exist.

In another paper on a related subject, I made the

statement that the study of the process of degeneration in a single nerve-cell, and the application of the result to the study of the whole mass, would enable us to get a clearer idea of the general conditions present, than an anatomical study of the brain substance. This mode of studying the functional derangements of the nervous system I have found equally useful in the study of insanity in general, and the associated sensory and motor disturbances. All sensory and motor manifestations, physiologically considered, represent different modes of motion resulting from activity of the nerve-cell; and this activity is constituted in the chemical changes which take place in the unstable complex organic material of which the nerve-cell is composed. The tendency in the potential nerve-cell is to manifest its activities along definite lines, the degree and nature of the activity being dependent upon the character and force of the stimulus. Beside this perceptive and energetic activity there is evidently, from the arrangement of functional cells throughout the nervous system a relational and associative activity, so that a stimulus of definite character not only sets up a reactive motion in the nerve-cell, but on account of association, sets up a similar activity in other nerve-cells; and a relational activity in a contiguous association of nerve-cells, so that the final reaction to the stimulus is made up of a series of simple reactions of varying intensity, but of analagous form, grouped into a complex, representing a definite discharge of energy. We have only to carry this synthesis a little further and combine a series of these complex groups, until we reach the culmination in the immensely complex activity represented in a series of co-ordinated somatic activities. By a reversal of this process, in analysis, we can trace the complicated stimulus through the various perceptive channels to the receptive centre, and its distribution to the cortical mass. The chemical activities involved also follow a definite course, representing so much genetic and so much destructive metabolism, the sum of which is the reconstruction of the nerve-cell,



and the reconstitution of its potentiality; at the same time that there is the formation of a series of chemical compounds, more homogeneous in type and more stable in character, consequently having no potential energy; but instead, calling forth other activities for their elimination. The persistence of these activities tends to their development along definite lines, so that finally only a minimum amount of energy is required for their manifestation. As a corollary of this we have the implication that all parts of the nervous mechanism, and especially the cortical mass, must retain their integrity, in order to insure the persistence of this definiteness and uniformity in the manifestations of motion. If we assume, as stated elsewhere by the writer, that the nervous mechanism in the foetus is endowed with a definite potentiality, and I believe that this proposition is supported by biological and physiological data, each nervous-cell is endowed with a definite amount of energy, or, in physiological terms, a limited amount of irritability and capacity for reconstitution. In a normal nervous system this potentiality would be equal in all its parts; but if, as is usually the case, the individual has some imperfection of development, some parts of the mechanism will have a lesser potentiality than others, and will be, therefore, relatively weaker, and in a condition to succumb to a smaller strain. On account of the dual function of the brain; that is, the control of somatic and mental life, an hereditary weakness of that part of the nervous system controlling somatic activities, would result in a relatively lower potentiality in the nerve-cells involved; and the converse of this would obtain, if the lesser potentiality involved that part of the brain concerned in mental functioning. Again, in the progress of development, the environment and experiences of the individual governed by the laws of organic development would further affect the potentiality of the nerve-cell, both generally and relatively; so that all activities would be equally potent, or in those subject to over-use and special strain, there would be loss of some of

their potentiality and a consequently lessened capacity for reconstitution. Taking, then, an individual who from hereditary or acquired causes has a relatively imperfect nervous structure, we would expect to find, as we do, that at times of special strain, such as the advent of puberty, the exigencies of social and industrial life, or the climacteric, they would display some signs of disturbance of the normal definiteness and uniformity of the activities of the nervous mechanism—motor or visceral, if the somatic functions were imperfect, and mental if that part of the functional mechanism was weakest. Of course the degree of disturbance would depend upon the amount of imperfection, and the character of the disturbance would be determined by the environment of the individual. Taking this thesis as a guide, let us study the gross manifestations of disturbed functioning of the brain and general nervous system under the conditions here premised.

All of the sensory and motor symptoms produced permanently by pressure, or gross lesion of the brain or cord, are produced temporarily by cell irritation or exhaustion, occurring during the course of chronic meningitis, sclerosis, or atrophy. By their gradual devolution they show the transition from the complex and heterogeneous to the simple and homogeneous, as in the dramatic purposive more or less perfectly co-ordinate motor expressions of hysteria, through the various violent motor discharges occurring in mania, to the automatic associated movements present in dementia; or the tremor and ataxia of maniacal exhaustion, through the gradually increasing inco-ordination and paresis of alcoholic or syphilitic degeneration, to the complete motor abeyance seen in the latter stages of these diseases and general paralysis. Two cases occurring in my experience, illustrate this degenerative transition of motor activities, and another, of mental activities. The first, a case of syphilitic brain disease, showed on admission, following a severe convulsion, paraphasia, myotonia, and paresis with tremor; also almost complete inhibition of intel-



lectual function, with suspicion and blind resistance toward any effort in his behalf. He gradually became worse; the paraphasia becoming complete motor aphasia, the myotonia degenerating into athetosis with astasia-abasia, and finally ending in excessive general tremor, with complete motor inco-ordination. At this stage another profound convulsion occurred, with a right hemiplegia. This was followed by gradual recovery, passing upward through the different stages traveled on the downward path, until he was able to walk about, feed himself, and speak intelligibly. This transition was repeated, with varying degrees of uniformity, three times in eight months; each transition showing the stages less well marked and being of shorter duration, until, following another severe convulsion, there was complete annihilation of mental life and voluntary motion, leaving only a vegetating mass of organized protoplasm.

The other, a case of general paralysis in the third stage, developed the symptoms typical of Thomsen's disease; this degenerating into an ataxia, resembling in its progress that form described as Friedreich's, and this followed in its turn by astasia-abasia, finally degenerating into a general athetosis with spastic tremor, and complete muscular inco-ordination. However, after even the simplest co-ordinate movement became impossible, each group of muscles could be made to contract firmly and co-ordinately, by a comparatively weak faradic current. The mechanism of speech went through a regularly progressive failure, beginning with explosive automatic utterance, and ending in complete aphonia. As long as there was any means of demonstration, automatic consciousness remained active. After a period of ten days he began to travel upward, over the same ground he had traveled downward, until he was finally, at the end of two months, able to walk about; and *pari passu*, automatic consciousness gradually gave way to active consciousness and the manifestation of considerable intelligence. During the transition described, the vegetative functions remained intact, because, as we would anticipate, they

were the most automatic. The third case, illustrating intellectual degeneration, occurred in a young girl, a low grade imbecile, who was admitted to the First Minnesota Hospital, with a history of epileptoid convulsions, with rapid mental reduction. On admission, she could express her wants, answer questions, and care for herself. Degeneration, however, proceeded very rapidly, paresis became marked, and she finally became bedfast. The vegetative functions remained intact, and the excrementary functions were automatically performed. She is now well nourished. Her muscular activities are automatic, like those of an infant, and her mental functioning is entirely rudimentary. She laughs and cries like a baby, but has no articulate expression, and is entirely without comprehension of spoken words—indeed she is in fact an infant, without capacity to relate or co-ordinate external impressions.

If my hypothesis, thus illustrated, is tenable, the deduction follows that the cerebral cortex is the originator of all the activities of the organism, and that those manifested automatically by the spinal centres, which we find in the reflex mechanism, are the result of the division of labor caused by evolution, and represent the development from the simple and lowly organized, to the complex and highly organized. These activities as they become organized, also become more and more uniform and persistent, until, without the intervention of active consciousness, they respond definitely to external impressions; leaving to the active consciousness the cognition, recognition, and relation of the constantly recurring new external impressions. It follows then that any breach in the integrity of the cortical function would produce disturbance of the uniformity and definiteness of its activities, while the reflex mechanism, subject to the same source of disturbance would react irregularly, giving rise to centrifugally excited activities without correspondence to external stimuli.

For convenience of study, the sensory and motor



disturbances associated with insanity, may be arranged as follows:

*Sensory.*—Disturbance of general sensation, including anæsthesia, analgesia, paræsthesia, and disturbed muscular sense; disturbance of the special senses, including auditory, visual, olfactory, gustatory, and tactual hallucination; illusion, manifested by associated perversions, and lastly, visceral hallucination.

*Motor Disturbance.*—Tremor, local or general, automatic associated movements, paresis and paralysis, involving special muscular groups, or general muscular function, vaso-motor disturbance, spasm and convulsion.

Analysis of these different forms of disturbed functional activity seems to me to lead inevitably to the conclusion that even in their most complex manifestations they are simply the outcome of increased or decreased irritability in the functional nerve cell; their complexity depending upon the number of functional groups associated, while they are manifested in their simplest form by the general involvement of the cerebro-spinal mass. The difference between hyperæsthesia and anæsthesia is only one of degree, as is that between paræsthesia and analgesia. Disturbance of muscle sense represents loss of the definiteness and uniformity of the activities involved, as do the different disturbances of the special senses manifested by hallucination. The difference between tremor, and spasm or convulsion is also one of degree—the one being a continuous excessive manifestation of cell irritability; the other, irregular explosive discharges of energy. The irritability being produced in the once case by exhaustion or auto-infection, and in the other by stimulation from pressure or the presence of some toxic material. Visceral hallucinations, in connection with insanity, are, in my experience, always the result of perverted impression, or more accurately speaking, a perverted relation in consciousness of visceral impressions. This is illustrated in varying degrees by the different disturbances of excretory function; beginning with the constipation and retention of urine, asso-

ciated with acute maniacal and stuporous states, where the domination of active by the automatic consciousness annihilates the visceral impression, or the inhibition of conduction interferes with their transmission; and going on to the systematized delusions present in hypochondriacal melancholia, although in the genesis of the systemized delusion there is apt to be an association of hallucination with illusion, as in the individual who believes that he cannot evacuate his bowels because they are paralyzed, or that he dare not let them move for fear that they will be extruded in the act of defecation; and built upon this the belief that on this account he must not eat, because the accumulation of food will burst him open. A case occurring in my experience is interesting, as showing how a systematized visceral delusion may result from a vivid external impression associated with another individual. The patient, the subject of agitated melancholia, refused for a year to eat, and resisted to the utmost any effort to evacuate her bowels, stating that her "anus was closed," and nothing could come from it; also that it was impossible for any food to stay on her stomach. There was no history of gastric or intestinal disturbance in this case; but the patient's husband had suffered from hæmorrhoids, which, for a long time, produced violent spasm of the sphincter during every effort at defecation, and her only child had suffered for a long time from dyspepsia, accompanied by vomiting and great suffering.

Illusion represents the purest type of perverted mental functioning. As ordinarily defined, however, illusion and hallucination are confounded. This confusion of definition is due, I believe, to the fact that these conditions so often co-exist and merge into each other. However, it seems to me, that if the conditions which constitute them are carefully studied, there ought not to be any difference of opinion as to the term of the definition. Subject to the personal equation in my own case, I would define an hallucination as the presence in consciousness of a series of impressions coming through a special



sense, which have been perverted in transmission, or imperfectly related in the receptive centre. Whereas an illusion is a picture, of which a dream is the type, which is projected on active consciousness from the latent or automatic consciousness, and is composed of a series of analogous pre-existing impressions, incongruously arranged. The persistence of an illusion or hallucination constitutes a delusion, which is therefore always a secondary condition. I know that this is not the usual definition of delusion, but I have never seen a case of insanity in which I have not been able to trace the delusion present to an antecedent illusion or hallucination, or both. The reason for this confusion in definition of these mental perversions is, I believe, that the conditions which give rise to them are not carefully enough analyzed in their earlier manifestations. The forms of insanity with which the various sensory and motor disturbances are associated, further confirm the generalization as stated. In states of exaltation, such as are present in maniacal hysteria, the different forms of mania, and in general paralysis in the second stage; all of the forms of sensory and motor activity are present in excess. The normal irritability of the nerve-cell is increased, but as a result of this excessive activity, impressions from all external sources are carried so rapidly and are so various that their cognition in consciousness is interfered with, and there follows imperfect relation and recognition, with resulting irregular inco-ordinate discharge of nervous energy, or in the terms of our generalization, a disturbance in the definiteness and uniformity of the activities of the functional nerve-cell. This is illustrated in the course pursued by the sensory and motor disturbances accompanying an attack of acute mania. The first manifestation is, as a rule, self-absorption and irritability; or, in other words, external impressions cease to be accurately cognized and related, and consciousness is dominated by the effort to overcome the resulting confusion; therefore external impressions are not fully recognized, and the resulting discharges of energy are

imperfectly co-ordinated. Now, if a sufficiently strong external impression, as a request or command, or contact is made to break in upon this concentration of effort, there results an irregular discharge of nervous force in the form of a petulant answer, or a violent outbreak of passion, accompanied by more or less violent motor activity in the form of an hysterical seizure, or even an assault. The confusion increases, the irritability becomes greater, until finally the inco-ordinated discharges of nervous force become continuous. Any one can witness out of his own personal experience, that these disturbances may occur in a modified degree in the sane individual when suffering from anxiety, or under great mental effort, and in the presence of acute pain. As the disturbance increases, the movements become less and less co-ordinated, until finally, as exhaustion supervenes, the ravings become a confused whisper, the movements degenerate into a general tremor, and annihilation supervenes. Or again, the confusion and inco-ordination reaching a certain degree of intensity, begin to subside, and the path is traveled backward, until definiteness and uniformity are again reached. The variations in this picture represent simply differences in degree, due to relative imperfections in the nervous mechanism in which they originated; while their persistence and termination will be governed by the extent of the imperfection, and the environment of the individual. From this typical order of manifestation all the partial forms of disturbance can be differentiated by recognizing that some parts of the nervous mechanism may retain their integrity, when that of other parts is more or less completely lost; and this is especially true of the more automatic activities, which require less expenditure of energy for their manifestation.

As a summary of the arguments based on my hypothesis, and the illustrations given, it seems to my way of thinking, that the following deductions are logical and warranted by the illustrations. The application of the theory of evolution to the study of the development of



the nervous system, and the normal manifestation of its activities, furnishes the best and most satisfactory basis for the study of the hereditary and acquired imperfections in its structure, with the resulting abnormal manifestations of functional activity, as well as the influence of the environment of the individual in determining the nature of the perversion. When we consider that the activities which, under the conditions resulting from heredity and environment, are normal in one individual, may be, under the different conditions surrounding another individual abnormal, we are placed in a position to appreciate the influence which the conditions of individual experience have in the development of perverted functional activity in the nervous mechanism: and as a corollary of this, the indication which these factors furnish for the alterations of environment necessary to subdue the undue activity and restore functional equilibrium. Again, with regard to the perverted sensory and motor activities themselves, it would follow that in an individual with inherited general imperfection of structure, the disturbance following strain or over-use would have the greatest tendency to uniformity in type; whereas any reduction in potentiality in the nervous mechanism due to hereditary weakness of a special part, or its disproportionate use, would result in variation in type with the disturbance most conspicuous in the part least able to bear the strain. This is illustrated most conspicuously in the changes which occur in the sensory and motor disturbances accompanying ordinary senility, natural or premature, and in that premature explosive form of senility which we term general paralysis of the insane, where the somatic reductions are most conspicuous in those cases where physical strain is the greatest, and mental reduction in those where psychical strain has been excessive. In conclusion I will venture the opinion that it is in the direction which the theory of evolution leads that we must look for future progress in the study of insanity and its associated disturbances, especially when its prevention and cure are the objects

sought, and we must look to biology and physiology rather than to pathology, for our guide in these studies.

I am aware that this paper is composed almost entirely of general statements, with little elaboration; but the limitation of time and the general character of the subject has made this necessary, lest from insufficient elaboration some parts of the argument might lose their due weight, while any attempt at discursiveness would be contrary to the object of the paper. It has been my object to present these generalizations from my personal observation and experience with the hope that they might excite discussion, and suggest to others, who, like myself, feel the limitations which clinical observation and morbid anatomy throw around our work, a method of study which may in their hands, with larger opportunities for observation and experiment, clear away some of the difficulties which now surround the study and treatment of diseased cerebro-spinal functioning.

While these studies have been based upon my own observation and experience, I am gratified to find that similar studies have been reported recently by others, eminently more fitted by experience and skill, in different forms of diseased nervous functioning, as well as in some of the other provinces of medicine. Notable among these are the "Harveian Lectures" for this year, "On Common Neuroses, or the Influence of the Neurotic Element in Disease, and Its Rational Treatment," by Jas. F. Goodhart, M.D. "The Bearing of Recent Biological Researches on the Practice of Medicine and Surgery," by G. Sims Woodhead, M.D. Also the "Lumleian Lectures" "Certain Points in the Etiology of Disease," by P. Pye Smith, M.D. All of these have appeared in the *London Lancet* since the first of the year. These studies have for their basis biological and physiological research, and the deduction from them is that the study of development and the normal performance of function, with the influence of environment in modifying the resultant activities, is the best basis for the study of abnormal functioning when it occurs.











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